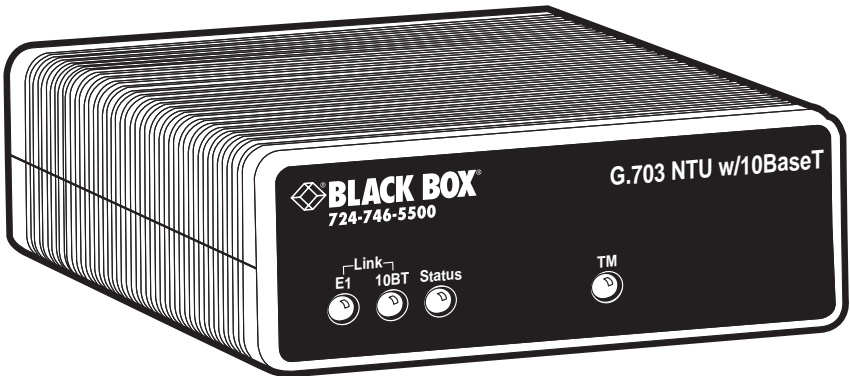




G.703 NTU w/10BaseT



CE NOTICE

The CE symbol on your Black Box equipment indicates that it is in compliance with the Electromagnetic Compatibility (EMC) directive and the Low Voltage Directive (LVD) of the European Union (EU). A Certificate of Compliance is available by contacting Technical Support.

RADIO AND TV INTERFERENCE

The Multi-Rate Ethernet Extender generates and uses radio frequency energy, and if not installed and used properly-that is, in strict accordance with the manufacturer's instructions-may cause interference to radio and television reception. The Multi-Rate Ethernet Extender has been tested and found to comply with the limits for a Class A computing device in accordance with specifications in Subpart B of Part 15 of FCC rules, which are designed to provide reasonable protection from such interference in a commercial installation. However, there is no guarantee that interference will not occur in a particular installation. If the Ethernet Extender does cause interference to radio or television reception, which can be determined by disconnecting the unit, the user is encouraged to try to correct the interference by one or more of the following measures: moving the computing equipment away from the receiver, re-orienting the receiving antenna and/or plugging the receiving equipment into a different AC outlet (such that the computing equipment and receiver are on different branches).

FCC PART 68



The MT330A is not intended to be connected to the public telephone network.

TRADEMARKS USED IN THIS MANUAL

All applied-for and registered trademarks are the property of their respective owners.

NORMAS OFICIALES MEXICANAS (NOM) ELECTRICAL SAFETY STATEMENT

Instrucciones De Seguridad

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.
2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.
3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.
4. Todas las instrucciones de operación y uso deben ser seguidas.
5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc.
6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.
7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.
8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.
9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libre-ros o gabinetes que impidan el flujo de aire por los orificios de ventilación.
10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.

11. El aparato eléctrico deberá ser conectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.
12. Precaución debe ser tomada de tal manera que la tierra física y la polarización del equipo no sea eliminada.
13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.
14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.
15. En caso de existir, una antena externa deberá ser localizada lejos de las líneas de energía.
16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.
17. Cuidado debe ser tomado de tal manera que objetos líquidos no sean derramados sobre la cubierta u orificios de ventilación.
18. Servicio por personal calificado deberá ser provisto cuando:
 - A. El cable de poder o el contacto ha sido dañado; u
 - B. Objetos han caído o líquido ha sido derramado dentro del aparato; o
 - C. El aparato ha sido expuesto a la lluvia; o
 - D. El aparato parece no operar normalmente o muestra un cambio en su desempeño; o
 - E. El aparato ha sido tirado o su cubierta ha sido dañada.

CONTENTS

CE Notice	2
Radio and TV Interference	2
FCC Part 68	3
Trademarks Used In This Manual	3
Normas Oficiales Mexicanas (NOM) Electrical Safety Statement	3
1. General Information	7
1.1 Features	7
1.2 Description	7
2. PPP Operational Background	8
2.3 Applications	8
3. Configuration	10
3.4 DIP Switch Configurations	10
3.4.1 Switch S1 settings	11
3.4.2 SW1-1 Line Coding: HDB3 (default)	11
4. Installation	13
4.5 Connecting to the G.703 Network and Ethernet LAN	13
4.5.3 Connecting Dual Coaxial Cable (75 ohm) to the G.703 Network	14
4.5.4 Connecting the Twisted Pair (120 ohm) to the G.703 Network	15
4.5.5 Connecting the 10Base-T Ethernet port to a PC (DTE)	15
4.5.6 Connecting the 10Base-T Ethernet Port to a Hub	16
4.5.7 Power Connection	16
5. Operation	17
5.6 Power-up	17
5.7 LED Status Monitors	17
5.8 Operating Line Loopback (LL)	19
A. G.703 Specifications	20
A.1 Network Data Rate	20
A.2 Network Connector	20
A.3 Nominal Impedance	20
A.4 Line Coding	20

A.5	Line Framing	20
A.6	Clocking	20
A.7	Distance	20
B.	Ethernet 10Base-T Specifications	21
B.8	DTE Interface	21
B.9	DTE Data Rates	21
B.10	LAN Connection	21
B.11	Protocol	21
B.12	MAC Address Table Size	21
B.13	MAC Address Aging	21
B.14	Frame Buffer	21
B.15	Frame Latency	21
B.16	Diagnostics	21
B.17	Indicators	21
B.18	Configuration	21
B.19	Power Supply	22
B.20	Humidity	22
B.21	Temperature	22
B.22	Dimensions	22

1. General Information

Thank you for your purchase of this Black Box product. If any questions arise during installation or use of the unit, contact Black Box Tech Support at (724) 746-5500.

1.1 Features

- Terminates G.703 E1 service
- Available in low-cost standalone or rack-mountable versions
- 2.048 Mbps data rate
- 10Base-T Ethernet bridge
- PPP (Point to Point Protocol, RFC 1661) with Bridge Control Protocol (RFC 1638)
- 75-ohm dual coax and 120-ohm twisted-pair G.703 connections
- Line loopback diagnostics
- Internal and G.703 network timing
- CE marked
- 100–240 VAC
- Conforms to ONP requirement CTR 12 for connection to international Telecom networks

1.2 Description

The MT330A receives clear channel E1/G.703 (2.048-Mbps) data from the telco's digital data network. The MT330A terminates the G.703 telco interface and converts the data for transmission to a user-oriented 10Base-T (802.3) Ethernet interface.

The Ethernet (MT330A) supports an integrated 10Base-T (802.3) Ethernet port with transparent bridging capability for IP, IPX, DECnet, NetBIOS and other layer-3 protocols. The MT330A attaches to the LAN and intelligently bridges data traffic to the large central site router through the telco's leased line network. The MT330A supports PPP (RFC 1661) and BCP (RFC 1638).

The MT330A is a 10Base-T bridge that operates over G.703 lines. It uses MAC learning and forwarding to provide seamless LAN-to-LAN connectivity. As a result, corporate enterprises can connect their servers to a pair of NTUs and automatically forward data packets that are meant for the remote network. Local packets are filtered and passed only to the local LAN.

2. PPP Operational Background

PPP is a protocol used for multi-plexed transport over a point-to-point link. PPP operates on all full duplex media, and is a symmetric peer-to-peer protocol, which can be divided into the following main components:

- A standard method to encapsulate datagrams over serial links
- A Link Control Protocol (LCP) to establish, configure, and test the data-link connection
- A family of Network Control Protocols (NCPs) to establish and configure different network layer protocols

In order to establish communications over a point-to-point link, each end of the PPP link must first announce its capabilities and agree on the parameters of the link's operation. This exchange is facilitated through LCP Configure-Request packets.

Once the link has been established and optional facilities have been negotiated, PPP will attempt to establish a network protocol. PPP will use Network Control Protocol (NCP) to choose and configure one or more network layer protocols. Once each of the network layer protocols have been configured, datagrams from the established network layer protocol can be sent over the link. The link will remain configured for these communications until explicit LCP or NCP packets close the link down, or until some external event occurs.

The PPP Bridging Control Protocol (BCP), defined in RFC 1638, configures and enables/disables the bridge protocol on both ends of the point-to-point link. BCP uses the same packet exchange mechanism as the Link Control Protocol (LCP). BCP is a Network Control Protocol of PPP, bridge packets may not be exchanged until PPP has reached the network layer protocol phase.

2.3 Applications

In situations where a routed network requires connectivity to a remote Ethernet network, the interface on a router can be configured as a PPP IP Half Bridge. The WAN line to the remote bridge functions as a Virtual Ethernet interface, effectively extending the routers WAN port connection to the remote network. The bridge device sends bridge packets (BPDU's) to the router's WAN interface. The router will receive the layer three address information and will forward these packets based on its IP address.

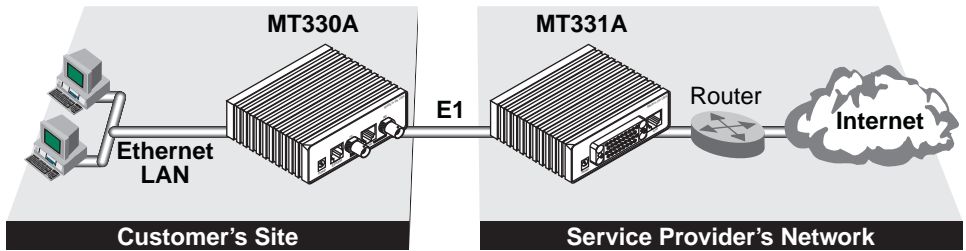


Figure 1. Router with serial interface, configured as PPP Half Bridge.

Figure 1 shows a typical router with a serial interface configured as a PPP Half Bridge. The router serial interface connects to the WAN via a MT331A (V.35) E1 NTU and to the remote MT330A with support for PPP bridging. The MT330A functions as a node on the remote Ethernet network. The serial interface on the router will have an IP address on the same Ethernet subnet as the bridge.

For example, the customer site is assigned the addresses 192.168.1.0/24 through 192.168.1.1/24. The address 192.168.1.1/24 is also the default gateway for the remote network. The above settings remove any routing/forwarding intelligence from the MT330A. The associated router configuration will set serial interface (s0) to accommodate half bridging for the above example.

```
!
interface s0
ppp bridge ip
ip address 192.168.1.1 255.255.255.0
!
```

Authentication is optional under PPP. In a point-to-point leased-line link, incoming customer facilities are usually fixed in nature, therefore authentication is generally not required.

Some networking systems do not define network numbers in packets sent out over a network. If a packet does not have a specific destination network number, a router will assume that the packet is set up for the local segment and will not forward it to any other sub-network. However, in cases where two devices need to communicate over the wide-area, bridging can be used to transport non-routable protocols.

3. Configuration

The MT330A features configuration capability via hardware DIP switches. This section describes all possible DIP switch configurations of the MT330A.

3.4 DIP Switch Configurations

The MT330A has an internal DIP switch that enables configuration for a wide range of applications. The DIP switch is accessed from the underside. Figure 2 shows the location of the DIP switches on the bottom of the printed circuit board.

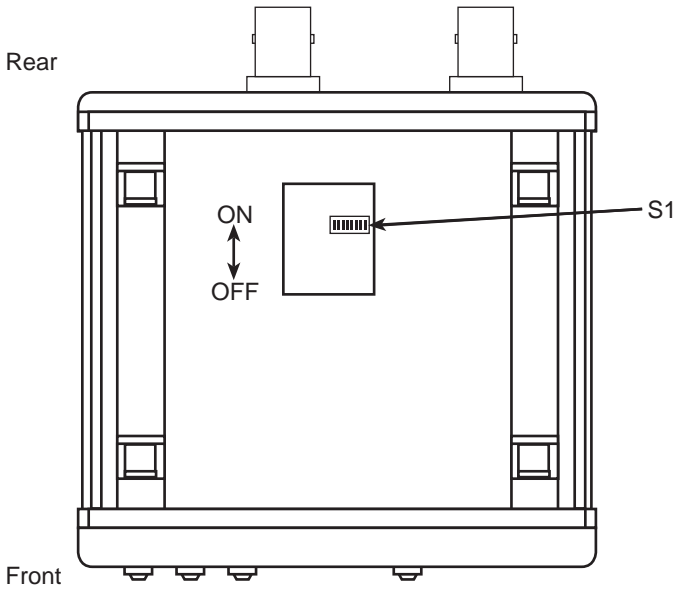


Figure 2. Underside of MT330A, showing location of DIP switches

The DIP switches can be configured as either “ON” or “OFF”. Figure 3 shows the orientation of the DIP switches with respect to ON/OFF positions.

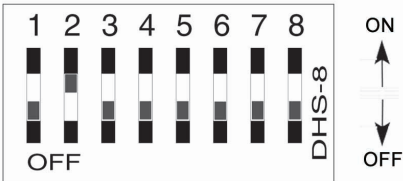


Figure 3. Close-up view of configuration switches

3.4.8 SWITCH S1 SETTINGS

Table 1 shows the settings for DIP switch S1-1 thru S1-8.

Table 1: Switch S1 settings

Switch	Description	Setting		
S1-1	Line Coding	Off = HDB3 On = AMI		
S1-2	Line Loopback (toward E1 line) Note The MT330A, when in line loopback mode, will loop the network line and return any traffic received on the E1 line to the sending device at the remote end.	Off = LLB disabled On = LLB enabled		
S1-3	Reserved	Off = Default		
S1-4	Reserved	Off = Default		
S1-5	Reserved	Off = Default		
S1-6/S1-7	Clocking	Switch 1-6 On On Off Off	Switch 1-7 On Off On Off	Network Internal (default) Reserved Network
S1-8	Reserved	Off = Default		

3.4.9 SW1-1 LINE CODING: HDB3 (DEFAULT)

Use Switch SW1-1 to control the Network Line Coding options. Set these options to be the same as the Line Coding given to you by your Service Provider. If you are using two MT330As together as short range modems, set both units to HDB3.

SW1-1	Line Encoding
Off	HDB3
On	AMI

Options: **HDB3**, **AMI**

- **HDB3**. In this line coding, the transmitter substitutes a deliberate bipolar violation when excessive zeros in the data stream are detected. The receiver recognizes these special violations and decodes them as zeros. This method enables the network to meet minimum pulse density requirements. Unless AMI is required in your application, HDB3 should be used whenever possible.
- **AMI**. Alternate Mark Inversion defines a pulse as a "mark," a binary one, as opposed to a zero. In an E1 network connection, signals are transmitted as a sequence of ones and zeros. Ones are sent as pulses, and zeros are sent as spaces, i.e., no pulse. Every other pulse is inverted from the previous pulse in polarity, so that the signal can be effectively transmitted. This means, however, that a long sequence of zeros in the data stream will cause problems, since the NTU receiving the signal relies on the signal to recover the 2.048 Mbps clock.

Note If you must use AMI, you should ensure that the data terminal equipment connected to the unit provides a minimally acceptable pulse density. For this reason, there are advantages to using HDB3 instead. AMI coding does not inherently account for ones density. To meet this requirement, the user should ensure that the data inherently meets pulse density requirements.

4. Installation

Once the MT330A is properly configured, it is ready to connect to the G.703 interface, to the Ethernet port, and to the power source. This section describes how to make these connections.

4.5 Connecting to the G.703 Network and Ethernet LAN

This section describes installing the G.703 (75-ohm and 120-ohm), Ethernet LAN, and power connections. Refer to the following to determine which installation procedures you will use:

- The 75-ohm dual-coax female BNCs (TX and RX) are used for connecting to a 75-ohm dual coax G.703 network interface. If your G.703 network terminates via dual coaxial cables, refer to section “Connecting Dual Coaxial Cable (75 ohm) to the G.703 Network” on page 14
- The 120-ohm RJ-48C jack is used for connecting to a 120-ohm twisted-pair G.703 network interface. If your G.703 network terminates with a RJ-48C, refer to section “Connecting the Twisted Pair (120 ohm) to the G.703 Network” on page 15.
- The Ethernet 10Base-T port is configured as DTE (Data Terminal Equipment). If the MT330A is to connect to another DTE device such as a 10Base-T network interface card in a PC, refer to “Connecting the 10Base-T Ethernet port to a PC (DTE)” on page 15. Otherwise, refer to “Connecting the 10Base-T Ethernet Port to a Hub” on page 16.
- Refer to “Power Connection” on page 16 to connect the MT330A to a 100–240 VAC source or to a 36–60 VDC DC-to-DC adapter.

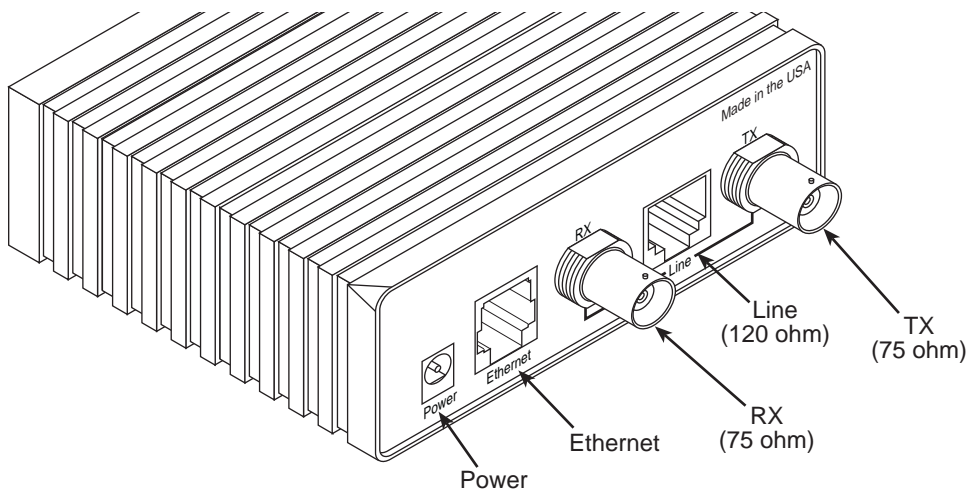


Figure 4. MT330A rear panel

4.5.10 CONNECTING DUAL COAXIAL CABLE (75 OHM) TO THE G.703 NETWORK

Refer to Figure 4 to make the proper connections.

Note The outer conductor of the coax cables are isolated from system earth ground.

When using the 75-ohm interface, jumper straps JP2, JP5, JP6, and JP7 must be installed over the jumpers. The jumpers are located next to the BNC connectors. Do the following to configure the jumpers:

1. Open the case by inserting a screwdriver into the slots and twist the screwdriver head slightly. The top half of the case will separate from the lower half of the case. Take caution not to damage any of the PC board mounted components
2. Open the case and install jumper straps for JP2, JP5, JP6, and JP7.

4.5.11 CONNECTING THE TWISTED PAIR (120 OHM) TO THE G.703 NETWORK

Refer to the pinout and signals chart in Figure 5 to connect the 120-ohm G.703 network channel.

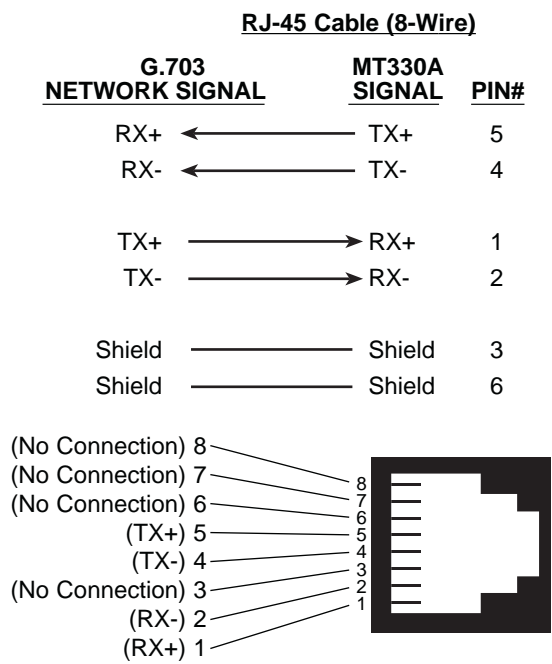


Figure 5. G.703 120-ohm connection.

4.5.12 CONNECTING THE 10BASE-T ETHERNET PORT TO A PC (DTE)

To connect the MT330A to another DTE device such as a 10Base-T network interface card, construct a 10Base-T crossover cable and connect the wires as shown in Figure 6 below and Figure 7 on page 16.

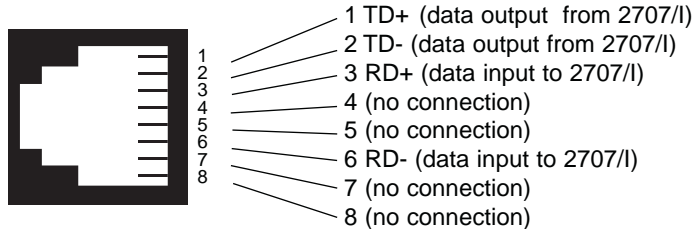
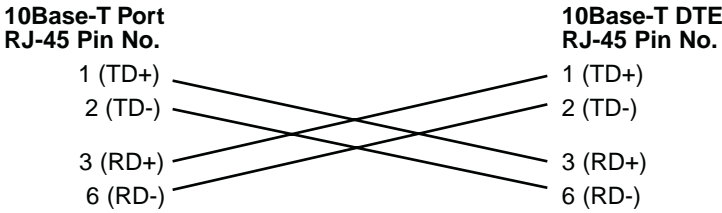
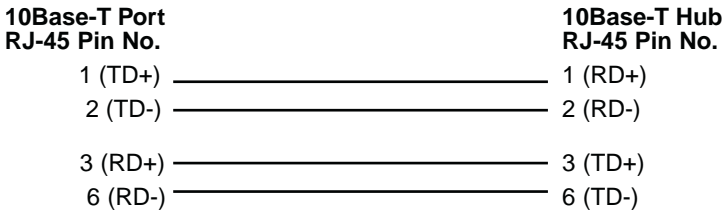


Figure 6. Connecting the 10Base-T Ethernet Port to a PC

**Figure 7.** 10Base-T cross-over cable connection**4.5.13 CONNECTING THE 10BASE-T ETHERNET PORT TO A HUB**

The 10Base-T interface is configured as DTE (data terminal equipment), just like a 10Base-T network interface card in a PC. Therefore, it “expects” to connect to a 10Base-T Hub using a straight-through RJ-45 cable. Refer to Figure 8 below and Figure 6 on page 15 to construct a cable to connect the 10 Base-T interface to a 10Base-T hub.

**Figure 8.** Connecting the 10Base-T Ethernet port to a hub**4.5.14 POWER CONNECTION**

The MT330A uses a 5VDC, 2A universal input 100–240VAC, power supply (center pin is +5V). The universal input power supply has a male IEC-320 power entry connector. This power supply connects to the MT330A by means of a barrel jack on the rear panel. Many international power cords are available for the universal power supply.

Note The MT330A powers up as soon as it is plugged into an AC outlet—there is no power switch.

5. Operation

When the MT330A has been properly configured and installed, it should operate transparently. This section describes power-up, LED status monitors, and the built-in loopback test modes.

5.6 Power-up

Before applying power to the MT330A, please review section “Power Connection” on page 16 to verify that the unit is properly connected to the appropriate power source.

5.7 LED Status Monitors

The MT330A features six front panel LEDs that monitor connections on the G.703 and 10Base-T links, signaling, error and test modes. Figure 9 shows the front panel location of each LED. Table 2 on page 18 lists descriptions of each LED.

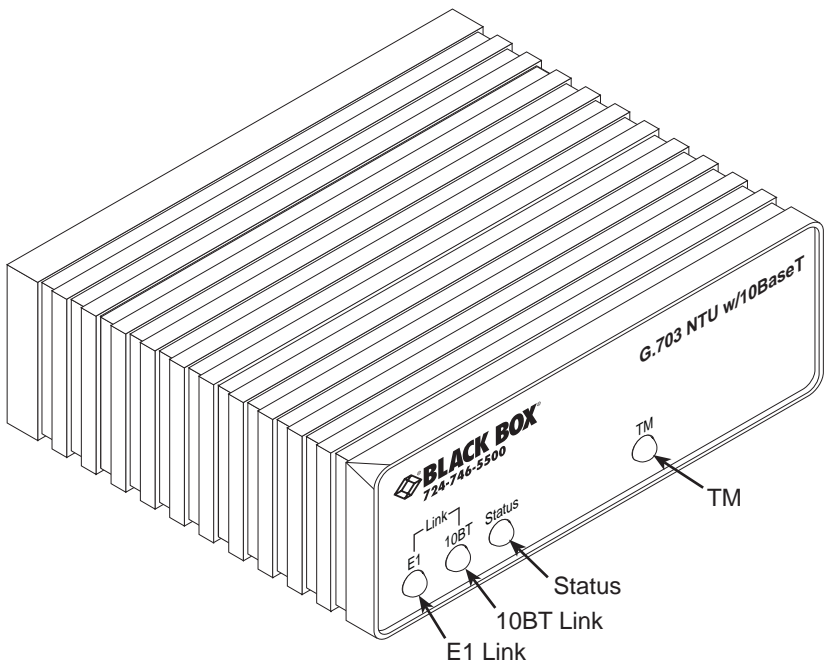


Figure 9. MT330A front panel

Table 2: LED descriptions

LED	Description
E1 Link	(Active Green) Solid green (On) indicates that the end to end E1 Link is up, signifying that the link is active. The E1 Link LED is Off when the link is down.
10BT Link	(Active Green) Solid green indicates that the 10Base-T Ethernet interface has detected a valid SQE heartbeat, signifying a valid 10Base-T connection.
Status	<p>Blinks yellow from one to eleven times to indicate system status. Each pulse pattern is separated by a 2 second "off" period. Greater pulse patterns have higher priority (buffer saturation has greater priority than an empty MAC table). Valid system statuses are:</p> <ul style="list-style-type: none"> 1 pulse—system status is okay 2 pulses —no MAC entries in the MAC Address Table 3 pulses—Clear to Send (CTS) or Carrier Detect (DCD) from base unit are not asserted 4 pulses—IM1/I buffer is saturated 5 pulses —WAN receive frame(s) too large 6 pulses —WAN receive frame(s) not octet aligned 7 pulses—WAN receive frame(s) aborted 8 pulses—Detected WAN receive frame(s) with CRC 9 pulses—Detected LAN receive frame(s) too large 10 pulses—Detected LAN receive frame(s) not octet aligned 11 pulses—Detected LAN receive frame(s) with bad CRC
TM	(Active Yellow) Solid Yellow indicates an Active Test Mode.

5.8 Operating Line Loopback (LL)

The Line Loopback (LL) test checks the operation of the local MT330A, and is performed separately on each unit.

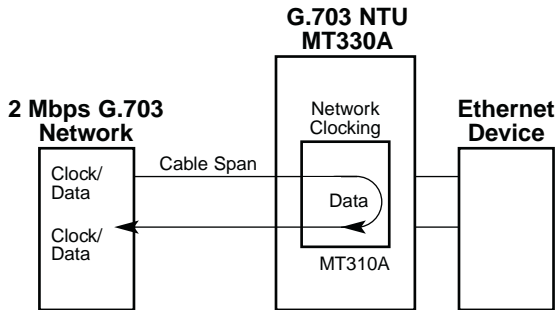


Figure 10. Line loopback for a network termination application

To perform an LL test, set DIP switch S1-2 to *On*. The TM LED will be lit while the unit is in loopback test mode.

A. G.703 Specifications

A.1 Network Data Rate

2.048 Mbps

A.2 Network Connector

RJ-48C/Dual Coax BNC

A.3 Nominal Impedance

75/120 ohm

A.4 Line Coding

Selectable AMI or HDB3

A.5 Line Framing

G.703 (Unframed)

A.6 Clocking

Internal or Network (Receive Recover)

A.7 Distance

Maximum 6,000 ft (1.6 km) On 24 AWG cable

B. Ethernet 10Base-T Specifications

B.8 DTE Interface

10Base-T on RJ-45F

B.9 DTE Data Rates

10 Mbps

B.10 LAN Connection

RJ-45, 10Base-T, 802.3 Ethernet

B.11 Protocol

PPP (RFC 1661) with Bridging Control (RFC 1638)

B.12 MAC Address Table Size

4096 entries

B.13 MAC Address Aging

MAC addresses deleted after 8 minutes of inactivity

B.14 Frame Buffer

512 Frames

B.15 Frame Latency

1 frame

B.16 Diagnostics

Line Loopback

B.17 Indicators

E-1 Link, 10Base-T Link, Ethernet Status, Test Mode

B.18 Configuration

8-Position DIP Switch

B.19 Power Supply

5 VDC external power supply 100–240VAC, 50–60Hz, 0.4A

B.20 Humidity

Up to 90% non-condensing

B.21 Temperature

0–50°C (32–122°F)

B.22 Dimensions

3.5L x 2.1W x 0.78H in.(9.0L x 5.3W x 2.0H cm)

Notes

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

